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ABSTRACT

This paper discusses the management of library collections of electronic information resources within the classical theoretical framework of collection development and management. The first section provides an overview of electronic information resources, including bibliographic databases, electronic journals, journal aggregation services, and Internet resources. The importance of a collections development policy is addressed in the second section, including the elements of selection, collection management, and collection evaluation. The next section considers the information technology (IT) infrastructure, and access issues, including user interfaces, training and support, copyright, licensing, authentication/authorization, and archiving/preservation. The fifth section discusses finance, including budgeting, consortia purchasing, and pricing. The final section deals with the future as it relates to libraries and the provision of electronic information resources. (Contains 47 references.) (MES)

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MANAGEMENT OF ELECTRONIC INFORMATION

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Introduction

The management of collections of electronic information resources raises a new set of issues for libraries, but these issues can still fit within the classical theoretical framework of collection development and management. Electronic information resources still need to be selected, acquired, catalogued, made available, and preserved, but in radically different ways from traditional print materials. The type of collection management issues raised by electronic information resources will, of course, vary between libraries depending on their individual missions. These issues cannot be addressed in isolation from print resources, and libraries need to begin to develop integrated collection policies for print and electronic resources. In this context, the role of the collection manager is vital in developing policies and structures that will integrate, across print and electronic media, the tasks of discovery, location, request and delivery. The skill of the collections manager will be to create collections which balance the best features of print and electronic resources, and which make them work together effectively in the interests of the library user.

Electronic information resources

Electronic information is a broad term that encompasses abstracting and indexing services, full-text materials such as newspapers and reference books, electronic journals and the offerings of electronic 'aggregators', article delivery services and free resources on the Internet. These electronic information resources can be accessed via electronic networks from third party information providers or mounted locally within the institution or within the library. There is also a growing corpus of digital research material produced by scholars as part of their research, but it is too early to say how libraries will manage access to this material. Therefore, this chapter does not attempt to address the significant collection management issues of this type of material, which are more properly being addressed by such bodies as The Arts and Humanities Data Service (AHDS) [1]. To explore the collection management issues that arise, it would be best to begin by examining the types of electronic information resources that are now available to libraries. Until relatively recently, electronic information resources referred to the library's provision of an online searching service of bibliographic databases, mounted on a host service like Dialog or STN. Online searching was usually mediated through a subject librarian, and in general users of the service were charged for the direct costs of the search. The responsibility for the overall management of this service usually lay with the public services staff of the library and this service did not raise any collection management issues. In the mid 1980s, some libraries began to provide self-service electronic information services by subscribing to the CD-ROM versions of online databases. Access was usually from stand-alone or networked workstations, but a few libraries added self-service online databases, mainly in the business area, and usually on a subscription rather than pay-as-you-go basis.

Bibliographic databases

At the beginning of 1991, there was a step change for UK higher education libraries in the provision of electronic information, when the university funding councils launched the BIDS (Bath Information and Data Services) ISI service. BIDS-ISI provides staff and students in subscribing institutions with free site license self-service access to the main ISI databases: *Science Citation Index, Social Science Citation Index,*

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Arts & Humanities Citation Index and *The Index to Scientific and Technical Proceedings (ISTP)*. Access to these datasets is generally managed by the institution's library, and the datasets are made available 'free at the point of use' to staff and students in subscribing institutions. These datasets had long existed in electronic form, even though their output had been in print, and so this enabled users to be provided with long back-runs of information, which helped the rapid take-up of the service. The effects of this initiative, have been 'truly revolutionary' [2] for academic libraries. The initial access to the ISI datasets tested the viability of the model of providing UK-wide access to networked bibliographic datasets and the success of the model led to a rapid expansion in the range of datasets. The number and range of networked datasets has increased substantially since 1991 and there are now over 40 major national dataset agreements in place for UK higher education. Most of these datasets are electronic versions of what had been printed abstracting and indexing services and were held by many libraries. Therefore as the datasets provided access to material which has traditionally been the province of libraries, they, rather than computer centres, took the lead in managing and funding these networked datasets. However, in spite of the increasing availability of networked datasets, CD-ROM still remains a popular medium for electronic resources, and increasingly for reference materials, and it is a medium which is particularly attractive for those institutions with an underdeveloped IT infrastructure. In 1996 academic libraries subscribed to 535 individual CD-ROM titles [3] and while many libraries continue to subscribe to the CD-ROM versions of bibliographic databases, there is a move towards network access to remote hosts, wherever practical.

Electronic journals

As staff and students became familiar with the BIDS bibliographic datasets, there has been an increasing demand for the full-text of the journal articles themselves, rather than just the pointers to them. However, full-text electronic journal services are still in their infancy with most major publishers only now experimenting with limited services and libraries do not like investing in experiments. Rather they prefer to be able to provide their users with reliable and supported services. In 1995, the funding bodies established Pilot Site Licence Initiative (PSLI) with the participation of four publishers - Academic Press, Blackwell Publishers, Blackwell Scientific, and The Institute of Physics Publishing. The aims of the initiative, which was to run for three years, are to explore the issues around providing access to a critical mass of electronic full-text journals; to test a national site licence concept for electronic journals between higher education institutions and publishers; and to provide libraries with a discount on the existing subscriptions to journals published by the participating publishers, so that they would consider subscribing to more titles. PSLI provides access to the full-text of over 250 recent journals from the four publishers, but one of the problems associated with the PSLI was that it was publisher-led rather than subject-led; and users do not in general approach information by publisher, but rather by subject. However, the initiative did stimulate libraries into embracing electronic journal developments earlier than they might otherwise have done, and did highlight some of the collection management issues that arise from mediating access to full-text journals. 'Libraries that might otherwise have been slow to develop have been forced to embrace electronic journal developments, and library staff and users have been able to become familiar with and benefit from new services' [4].

In general, the initiative is a welcome learning experience for most libraries on the issues involved in managing collections of electronic journals, but the lessons learnt are necessarily limited, as it was initially to be only a three year experiment. Most respondents to the evaluation noted that it was not possible therefore to make long-term decisions on cancelling those print journals that were now being made available in electronic format. They considered that there is a need for greater certainty about the future of the scheme, for the technology to be stable, and for the archiving issues to be resolved before some would commit themselves to a shift from paper to electronic. Of course, the initiative was not just for the benefit of librarians, but was intended to improve access to the full text of journals for the users of libraries. Where libraries were able to obtain feedback from users, it was generally very positive. This was particularly the case with the physics community, who are in general comfortable with IT and saw the initiative as particularly relevant to them, as it was led by a specialist physics publisher - The Institute of Physics

Publishing. The scheme is to continue and be expanded beyond 1998 under another title - National Electronic Site License Initiative (NESLI) - but on 'full cost recovery' and without any funding from the higher education funding councils, but it is too early to speculate on the future take-up of the Initiative by libraries.

Journal aggregation services

Full-text electronic journals are, of course, not confined to the PSLI, but many individual publishers are now making full-text electronic journals available, but only of recent issues. This is leading to an increasingly confused environment for libraries with the different access methods and licences being offered by each publisher. Before committing on a major scale to providing users with access to the full-text of electronic libraries, there is a need to balance the benefits against the costs of managing these individual services. In anticipation of a market demand, a number of organisations, often subscription agents, are establishing journal aggregation services for publishers. These services provide simplified and integrated access to a range of electronic journals, in the same way as subscription agents now manage the supply of printed journals. Journal aggregation services include Blackwells Electronic Journal Navigator [5], SwetsNet [6], and BIDS Journals Online which

> "offers access to over 58,000 full text electronic articles from an expanding range of more than 450 academic journals from publishers such as Academic Press, Gordon and Breach, Arnold, Blackwell Publishers and Blackwell Science. Full text access is available generally to subscribers only, though some articles may be ordered individually using account or credit card facilities". [7]

There are also subject-based aggregation services such as *European Business ASAP*[8], which provides Internet access to the full text of over 200,000 articles from over 100 business and trade publications. The advantages of these new full-text aggregation and subscription management services are the same advantages that are provided for libraries by the management of printed journals, having one source to deal with for subscriptions, receipt, claiming and payment. For electronic journals the advantages claimed by aggregation services include the management of password distribution, license administration, managing access, archiving, and recording use of titles. The alternative to this one stop 'supermarket' approach, where users can find all the electronic journals metaphorically on the shelf and available for use, is the 'boutique' model with a multitude of isolated hand-crafted publisher sites, which users may or may not discover. One of the keys to the take up of these new services will be the number of publishers that an aggregation service can sign up, and how quickly each service can build a critical mass. In the meantime, most libraries are waiting for the market to mature and for one of the services to emerge as the market leader before subscribing.

Internet resources

Libraries are increasingly considering if and how to provide access to relevant Internet resources for their users, but any move into this area should be addressed as part of the library's overall collections policy for electronic resources. Most libraries mount pages on their institution's CWIS, which not only describe the library's services, but include pointers to relevant Internet sites [9]. A library can attempt to manage and add value to the Internet in this way, in the same way that it manages and adds value to other information resources. But the same principles, and management overheads, that apply to developing and managing collections of printed and 'paid-for' electronic information resources, also apply to a library's collection of free Internet resources. There is a need to define the scope of the collection, to allocate collecting responsibilities and to ensure that mechanisms are in place to maintain the collection and review its effectiveness. The alternative strategy, which may be more cost-effective than developing local collections of Internet resources, is to provide pointers to existing external subject gateways, such as EEVL, SOSIG, TipTop etc. [10], and then to fill in any gaps locally. In the Internet environment, there may be a need to regulate or restrict access to information, which contrasts with the traditional role that libraries have always

had of aiming to improve access to information. Restricting access to 'unsuitable' Internet sites can be dealt with by software 'nannies', which prevent access to designated sites, but it is usually dealt with by the university's regulations. As libraries now house clusters of networked workstations, they can be in the front line of enforcing any institutional access restrictions. They need therefore to ensure at the drafting stage that the regulations are enforceable and establish guidelines for how their staff should deal with any problems that arise.

Collections development policy

There is now such a wide range of electronic information resources available to libraries that selection decisions should be made within an explicit collection development policy. 'Selection of electronic resources outside the guidance of a collection development policy leads to haphazard unfocused groupings of resources that may or may not support the mission of the library' [11]. An explicit collections policy will at least prevent the library from being driven by events or by individual enthusiasms and from purchasing a random set of resources which it then cannot support. A collections policy will also help the library to head off the inevitable resistance to change from within the institution. There is considerable room for debate as to whether libraries need, for example, a separate collections policy for electronic resources, as libraries do not need a separate collections policy for oversize books. However, most libraries are still in their infancy as regards providing access to electronic information and therefore need to proceed in a measured and structured way by isolating the collections management issues of electronic information. In time, as print and electronic resources reach more of a balance, a fully integrated collections policy will be appropriate, but that time has not yet arrived.

There will always be some resistance to moves away from the comfort of printed resources into the uncertain world of electronic resources, and the library has therefore to make sure that it does not appear to move too fast for its users. It is important that any major move into electronic resources is presented within the institution as being part of an agreed library strategy which has at least some degree of institutional support. A more subtle approach can be taken by labelling 'innovations with conservative titles; encouraging users to think that major changes are merely minor modifications to existing practice; claiming, if you can, to be reverting to traditional procedures which may, more recently, have been corrupted by less worthy successors' [12], but this will depend on local circumstances.

At the broadest level, a collections policy for electronic resources would deal with subject coverage by, for example, aiming to support all the major research areas with the major bibliographic databases, or it may be that the library wishes to be selective and target some specific subject areas in order to effect cultural change. The selection policy will address information formats and their technological implications both for the library and the institution. It will also address the management and staffing issues of supporting electronic resources. Whatever is in the policy statements, they have above all to be flexible and will need to be interpreted sensitively within the context of local needs, priorities and culture. A research-led university is more likely to concentrate on providing the major bibliographic datasets which match the subject profile of the institution, whereas a university which has teaching as its primary mission, is more likely to concentrate on providing access to full-text services on CD-ROM. In an ideal world, this collections policy would be part of an institutional Information Strategy [13], which aims to place the management of library mediated information resources, both print and electronic, in an institutional context. However, few institutions have yet developed a full information strategy and few libraries have the luxury of waiting for this to happen, so on the principle of 'the best being the enemy of the good', libraries often have little option but to proceed in a policy vacuum.

One of the major considerations to be addressed in the collections policy will be balancing user wants and needs for electronic information resources. It is well understood that an academic's first demand for additional library resources will almost always focus on more print journals. The surveys undertaken in 1995 by Ehrens showed that when academic staff were asked what improvements could be made to their

institution's library that would be of most benefit for their own area of research, by far the main priority was to have an improved journal collection [14]. Fourth on the list, after improved book and research report collections, was better access to external electronic databases. This raises questions of does the library know best about the information needs of its users and should it attempt to lead or to follow its users.

Selection

'Choosing among formats, identifying what is available, analyzing costs, understanding licences and other legal concerns, interpreting service implications, considering preservation, preparing equipment and facilities, and developing local approaches for acquiring, cataloguing and processing electronic resources introduces new challenges' [15]. On the face of it, the selection criteria for an electronic information resources are similar to those employed for the selection of print resources - does it meet the information needs of users and does it represent value for money? Selecting an electronic resource is not as straightforward as selecting a printed resource and involves a large number of additional issues apart from the appropriateness of the information content of the resource. As the detail of the selection criteria is developed, there needs to be a check-list in place which identifies the range of issues that will need to be brought to the decision-making. Johnson [16] suggest the following set of particular considerations that should be addressed when selecting electronic resources, once a decision to purchase is likely:

- network, hardware and software compatibility;
- availability of network, hardware and software resources;
- availability of electrical and telecommunications lines;
- quality of interface (ease of use for library users and staff);
- quality of retrieval/search engine;
- training implications;
- potential use (size of user community and frequency of use);
- reliability of vendor and availability of vendor support;
- availability of documentation;
- licensing considerations;
- treatment of graphics, formula, and other non-standard characters.

It is vital to ensure that full ownership of decisions to purchase is taken by all the stakeholders in the library, and there may be a need to establish a standing committee/working group on electronic resources with wide representation, in order to co-ordinate selection decisions. It is important to be aware that the process of acquiring, delivering and supporting electronic resources involves staff from all parts of the library, including systems, acquisition, cataloguing, preservation and reader services. When resources are selected, the ability of the library to provide and support access and the capability of the user to access the resource need to be considered before a decision is made, and such a decision will need the support of all relevant sections of the library. Selection decisions cannot therefore be taken without reference to the library's technical staff to ensure that the infrastructure is adequate and that there is sufficient expertise to provide technical support for the new dataset. There also needs to ensure that the public service staff are not only aware of new datasets but also have the necessary skills to support users. 'Basic techniques such as checklists, careful planning and systematic procedures for the introduction of new services support the sense of professionalism among staff who feel inadequate in the eyes of users when new services appear to be run chaotically' [17]. Much of this can be addressed in advance of purchase as, given the higher relative cost and service implications of electronic resources, libraries can usually arrange a trial of a new major electronic resource. A trial will ensure that not only the quality of the data and its presentation can be assessed, but also any access and support issues can be identified in advance of purchase. This is also a good moment to involve users in the decision-making process and to assess their reactions to the dataset during the trial period.

Collection management

The daily management of electronic information resources present enormous opportunities and challenges for all library staff, but also involve significant management overheads, including licensing negotiations and monitoring, equipment provision and support, training and awareness costs. In particular, the staffing implications of each move into electronic resources needs to be thought through, particularly the possible need for new staff skills. There is a need for a combination of a relatively high level of technological and information skills to be combined in at least one person, and many libraries have addressed this challenge by creating a new post of Networked Information Services Librarian. While all library staff need to acquire new skills in the use and promotion of electronic resources, this type of designated 'hybrid' information professional post is becoming increasingly common in libraries.

The effective provision of electronic information is often hindered by outmoded institutional structures. There is a need for the active and willing support of other academic services, in particular an institution's computing services and ideally this should be within an accepted organisational structure. However, there is often a clash of organisational cultures between libraries and computing services [18] and it has been implied (usually by librarians) that libraries have a service orientation, while computer centres have a product orientation. There may also be personal incompatibilities and it has been suggested [19] that librarians and computing staff are like oil and water: unable to mix or work together. These characterisations are based on stereotypes, but if the information needs of staff and students are to be met, it is vital that libraries and computer centres find effective ways of collaborating. Of course, the remit of a central computing service will also vary from institution to institution, as will the organisational structure for the library and other support services. If the library and the computing service are operationally 'converged' under the same management structure, it will be infinitely more straightforward to provide effective and managed access to the whole range of electronic information resources [20]. If the two services are independently managed, then there will need to be negotiation to establish a harmonisation of priorities between the two services. However, the computer centre is only one of the stakeholders in this game and there will often be a need to negotiate with computing staff in academic departments. If the remit of the central computing service stops at the 'front door' of an academic department, then the library will also need the active support of computing staff in each academic department to ensure that access to networked information resources is indeed pervasive across the institution. The first requirement will be for an adequate network infrastructure within the department, and each member of staff will need to have an adequate networked workstation on their desk, together with the necessary software and support. The library will therefore need to ensure that, as part of its collections policy for electronic resources, that it develops good relationships with a very wide range of service providers across the institution.

Collection evaluation

Libraries, as a service, have always been concerned with measuring their performance in meeting the needs of their users, and of ensuring that the resources they select are of use to their clients. In recent years, interest in performance measurement has been intense. This has been partly due to pressure on resources which has led to a more focused search for efficiency of operation, together with a concern for the needs of users which has focused libraries on addressing measures of effectiveness. There has also been pressure from funding bodies for a demonstration of value for money and, at the same time, users of the libraries services have become more demanding. These pressures were recognised in the Follett Report [21], which recommended the development of generally accepted and reliable performance indicators for UK higher education libraries. However, the concentration had been on measuring the performance of a library made up of essentially local print collections, but many of these measures are not applicable to measuring the performance of the library in an electronic environment. There is a need for 'the development of robust management information and performance measurement systems for electronic libraries' [22]. The CERLIM study highlighted the problems:

"Electronic services are increasingly being delivered to the desk-top, outside the library and possibly off-campus. User may no longer require the services of either expert library staff, or access to a physical stock of materials to make effective use of 'library' services. In these circumstances:

- library staff may not know who is using which service, and may be ignorant of alternatives which users find for themselves;
- it is very difficult to know how much use is being made of the services provided by the library;
- the effectiveness of services is difficult to judge."

The report identifies new performance indicators that are suitable for use in the management of the electronic library. One of the central issues identified in the research was the need to focus on the impact of electronic resources on the user. 'Staff and students in academic institutions make extensive use of electronic information resources, but we do not know which services are of the greatest value [23], nor how one service compares with another, nor, to any great extent, what it is about a service which gives it value'. It is important therefore that a widely applicable tool-kit of performance measures are developed and tested for library managers to use in developing their own local electronic library.

IT infrastructure

It is paradoxical that the promise of extended access to information that electronic resources holds out is accompanied by significant problems of providing that access. As the range and format of electronic information resources increases, libraries are dependent for the delivery of their services on a robust IT infrastructure, within the institution, and both nationally and internationally. Until recently, libraries could operate in a relatively technically self-supporting way within their institution, only requiring the support of institution's computing service to provide and manage the campus technological infrastructure and the connection to the Internet. However, once a library has made the decision to provide their users with access to electronic information resources, it is taking on a continuing commitment to ensure that both it and the institution sustain an adequate technological infrastructure to allow this access. The exact nature of the IT infrastructure requirements will, of course, depend on the method through which the information resource is to be delivered. If the resource is to be installed on a stand-alone CD-ROM workstation, then the requirements are relatively simple and within the capability of most libraries to set up and manage. Many libraries have now moved beyond stand-alone access to CD-ROM datasets and have networked these datasets, either within the library building or across the campus. Managing CD-ROM networks requires considerable technical input, and a continuous source of funding to develop and expand the network. Many libraries are now finding that they cannot guarantee to not have the necessary expertise in the library, nor the funds to be able to upgrade periodically both the hardware and software on the network. They are therefore moving to host access to datasets such as that provided by Silverplatter's ARC service, which frees the library from having to manage their own network infrastructure. If the library is to provide access to networked datasets, then it will need to also rely on a robust local and national network infrastructure and sometimes on robust and responsive international network links. Even though the 'fat pipe' between the UK and the USA is being continually upgraded, use quickly overtakes capacity, and a library therefore needs to consider the practicality of subscribing to US-based databases, when afternoon access can be painfully slow.

The increase in electronic information resources has moved the responsibility for providing print copies from the library to the user, though the library still has a service obligation to try and ensure user access to printing facilities. The growth of electronic information resources is leading to an increased demand for printing facilities, and failure to provide adequate printing facilities will be seen by users as a diminution of service. Printing requirements will range from needing prints from a CD-ROM dataset, to wanting the full-text of an article in an electronic journal, including colour graphics. The library might meet the first need by providing free dot-matrix printers for each stand-alone workstation, but the staff costs in managing and supporting this facility need to be considered. Alternatively, the library may require the user to download the information from the database to a floppy disk and take the disk elsewhere for printing. More

sophisticated printing requirements, which may require a networked Postscript printer, cannot usually be met by the library alone, but will require an institutional infrastructure that supports the provision of network printing facilities. The cost of obtaining, supporting and upgrading local equipment has therefore to be considered within the collections policy, but often the cost can be met from other institutional budgets, as it can be made available for other uses.

The growth in the provision of electronic information resources is also having an impact on the planning and use of library buildings. Tables need to be bigger to accommodate computer workstations, space needs to be provided for printers and for the essential distribution equipment, and lighting, noise levels and environmental conditions need to be addressed [24]. These issues are, of course, best addressed in the context of designing a new building, but most libraries do not have this luxury and must attempt to adapt existing buildings to newer uses. A library's electronic collection strategy for may therefore be significantly influenced by the extent to which the library building can provide the necessary IT infrastructure and can be made hospitable to new uses.

Access

User interfaces
The question of how best to provide access to each electronic resource has to be fully considered and there is a need to build easy to use and integrated interfaces to electronic resources, which can be supported and updated. Most libraries manage access to networked information resources through their Web pages [25], but if a library wants to provide its users with a fully integrated collection of resources, regardless of the media in which they are available, then ideally there should be one point of discovery and access to the resources [26]. For example, information on both the print and electronic resources that the library subscribes to could be via the OPAC, with the added benefit of providing a 'single-click' access to the text of the electronic resource. In the same way, integrated access to Internet resources could be provided, and some libraries have even gone so far as to fully catalogue Internet resources and provide access to them via the OPAC, though many doubt the scalability of such an approach. The practicality of using the OPAC for integrated access will, of course, depend on whether the library has a Web-based OPAC, and it raises issues of how access to the OPAC should be managed. If the OPAC has become, in effect, a networked PC that provides unrestricted access to both the Internet and networked datasets, then there will be a tendency for users to spend a lot of time at the OPAC, rather than just quickly finding the classmark of a particular book and leaving the terminal for the next person. An unrestricted network PC also raises network security issues, as it has no audit trail and allows 'walk-in' users to freely use those datasets to which access is regulated only by IP source address.

Training and support Users still lack the confidence that electronic resources can be adequate substitutes for print resources which, in their eyes, are always physically available throughout the opening hours of the library. The speed at which individual subject areas move towards using electronic information resources will vary considerably and will not only be influenced by the availability of datasets, but also by the prevailing 'computer culture' in the particular academic department. Reluctant users are ready to see complicated and sometimes unreliable technology coming between them and the information resource, and they are often willing therefore to trade the convenience of desk-top access for the perceived reliability of physical access. However, there is now a general acceptance among most members of the academic community (though each institution will have pockets of resistance), that electronic information services will have a considerable impact on their work and that these services will improve as time goes on. Many staff are unaware of what is available to them and what a particular resource could do for them. There is a need for awareness and support activities at a number of levels, from raising awareness of the existence of electronic resources, to training in the technology and interface, to providing the skills necessary to make use of a particular resource. The library is only one of the stakeholders involved in promoting the use of electronic resources and it needs to ensure that its promotion strategy is in harmony with other national and

local initiatives. The first role of the library is to actively and constantly promote both the awareness of and the use of electronic resources if a return on its investment in these new services is to be realised. This will mean developing a continuing local publicity strategy for electronic resources, which would include the production and distribution of leaflets and guides - both printed and Web-based- providing seminars for researchers, academic staff and undergraduates, running 'show and tell' sessions, and making use of other institutional opportunities. Users often need a new set of skills to make full use of electronic resources and many institutions are meeting this need, at least for students, by providing formal information skills training. This can be on a departmental or an institution-wide basis, and the latter method could be accompanied by certificating a set of basic IT skills. It is important for the library to have an input into this process, at least to ensure that the programme includes the necessary information skills that a student will need to discover and use the available electronic resources.

The library will also need to address how it can provide a help facility for users of electronic resources, especially as most of the usage of these resources will take place outside the library. 70% of BIDS usage is still via VT100, and it is likely that most users will match this 'old fashioned' access method with an 'old fashioned' usage pattern of the databases. They may also be passing these bad habits onto their students when they introduce them to these datasets and the library will need to intervene in this process, but its intervention may not always be welcomed. Many institutions are developing distance-learning courses and one of the major issues for the library is how to support effectively the information needs of users who are not only outside the library, but may be outside the institution. The need here is for the library to ensure that it is involved at an early stage with course designers, so that the practical issues of supporting distance learners can be addressed. There is also a need to ensure that library staff are aware of the range of electronic resources to which the library subscribes, and are aware of the level of support that they may be expected to provide. New skills will be required from library staff [27] if they are to provide the integrated support that users of electronic resources expect, and more and more libraries are setting aside a weekly 'training hour' when the library is closed for staff training. However, awareness and understanding does not begin and end with the library staff or the users, but it also involves the other support staff in the institution, together with the institution's senior management, who all need to share in the library's vision.

Copyright

'Electronic media present new challenges to copyright holders...Copyrighted material converted into digital form can be copied perfectly without any damage or diminution in the quality of the original' [28]. Electronic copyright is an uncertain area, but one where the establishment of an easily understood legal framework is needed in the interests of publishers, users and libraries. Although the Dearing Report [29] on higher education recommended to the government that copyright law be amended to give teachers and researchers easier access to digitised documents for research and study, the government has since indicated that it does not intend to change the law at present. However, if progress is to be made in building functioning electronic libraries, it is vital that the uncertainty over the use of digital material is removed. Publishers are naturally concerned that unregulated access and 'seepage' of their machine-readable data over the Internet might affect the level of return on their investment in publications. They fear that their business is threatened if permission is given to users to copy and then widely distribute materials that they have invested in to create. They wish therefore to regulate the use of their information by erecting barriers to the storage and access of their information, which contrasts with users who want to download material, annotate it and forward it freely to others. Digital copyright is, of course, an international and a wider European issue [30], but there are now a number of initiatives in progress in the UK to address the issues. JISC and the Publishers' Association have been working towards developing a set of agreed guidelines on digital copyright clearance and on digital inter-library lending, and on developing 'model licences' for the use of digital data [31]. Libraries are caught in the middle of all this activity and have the task of 'imposing rules set down by the law which may bear no resemblance to the realities of fulfilling demands from staff and students' [32]. Librarians are used to dealing with the regulation of print copyright and they can act as

honest brokers in the electronic environment, if they can convince publishers that they can create a controlled environment within their institutions that provides protection for rights holders.

Licencing

The usage of datasets is usually regulated by licencing arrangements, whereby the supplier leases the data to the library and its 'authorised users' make use of the it, subject to a set of conditions. For example, CD-ROM databases can either be licenced for single use on a stand-alone workstations or for multiple use on a CD-ROM network, with a significant price difference between the two. Licencing conditions may also be so complex that there can be a need for the library to consult an institution's legal advisers on the terms of a licence before it is signed.

There are a number of ways in which a supplier might regulate access to an electronic networked product. It can be by individual or institutional password, or by password plus IP source address, or by institutional IP source address alone, or even by institutional sub-nets. In the latter example, access to a dataset would be restricted to network calls originating only from within the subscribing site, and so a user might only be able to access the dataset if they are physically within the institution and so within its network 'domain'. As higher education institution move towards off-campus learning, which may be promoted to potential students as providing the same learning experience as on-campus courses, students will then expect the same access to networked datasets from both on- and off-campus. The discussion needs therefore to centre more on 'group' or 'community' licences, rather than simply 'site' licences, as the physical location of the user is often not the key membership criteria. In the above example, access can be dealt with by ensuring that off-campus students access the dataset by first connecting to the campus network and then to the dataset. If this is required, the library will need to convince the computer centre of the importance of the issue and negotiate with them to ensure that they support the local and national dial-up facilities are in place [33]. However, some dataset providers will only allow password access to their information, regardless of where the network call originates and while this method is easier to manage, it requires the library to organise the issuing of passwords, and for the user to remember yet another id and password. All these access restrictions, which will inevitably vary between datasets, will have to be managed and mediated to the user by the library, and this constitutes a considerable management overhead and possible bar to use. It is also possible that each dataset could have separate licence terms and one of the fears of librarians is that they will have to negotiate different licence agreements with, for example, each journal publisher. With over 15,000 journal publishers, this is clearly not practical. There is a need therefore for a model set of licence terms to be agreed and this is likely to be one of the outcomes of the discussions between JISC and the PA, at least for the UK.

When 'authorised users' is defined as the staff and registered students of the institution, it can mean that access cannot be provided to external or 'walk-in' users of the library, unless it is specifically negotiated with the data supplier. Many libraries have actively marketed their services to the local business community, or they may have a science or research park on the campus, where access to the university library is promoted as one of the benefits of locating on the park. A significant move into electronic information services will therefore represent a decline in the information resources that are available to external users. This contrasts with the ability of external users to make unrestricted use of printed material in a library, once they have been granted access. However, even if the site licence can be extended to such users, there is the problem of how to gain access to the database, as this will in most cases be via the campus network, which is usually only available to staff and registered students.

Authentication and authorisation

By taking out a licence for a dataset, a library has also taken on the responsibility for ensuring that the terms of the licence are adhered to, and for ensuring that only authorised users access the data. For a network resource, this may involve authenticating the user, prior to authorising them to have access. Authentication can be defined as the process whereby a network user establishes a right to an identity (or

possibly multiple identities), and authorisation is the process of determining whether a particular identity is permitted to access a resource. Libraries have observed that one of the major deterrents to the rapid and pervasive take-up of electronic information resources has been the variety of authentication and authorisation mechanisms in use, and therefore the number of user ids and passwords that have to be learnt and remembered. In order to address this issue, JISC has recently funded NISS [34] to develop and manage a national centralised authorisation service, based on institutional authentication. The new service - ATHENS - is intended to provide a single sign-on, with the same username and password, to all JISC-funded datasets and provide a transferable model. ATHENS has been designed to meet the needs of both the user, by providing easy access to datasets, but also to protect the needs of the resource supplier by providing strong safeguards on the security of the data. When ATHENS is in place, and all existing JISC dataset users have been provided re-authenticated, libraries should find that one of the major access barriers to networked electronic resources has been removed.

Archiving and preservation

One of the central issues relating to the licensing of networked datasets is whether the institution will have continuing access to the backfiles of the data after the licence has expired. With a print resource, a library presently retains the books and journals that it has purchased, and users of the library can access the backfiles of a printed journal even though a current subscription may not be held. This contrasts with most licensing models for electronic resources where no guarantee of continuing access to back files exists, once the subscription has lapsed. Most libraries have taken the decisions to maintain data in only one format, and , for example, as the ISI datasets became available through BIDS, libraries generally cancelled their printed or CD-ROM versions of the Citation Indexes. When the BIDS-ISI deal comes up for renewal, a library may decide not to renew its subscription or ISI may decide not to licence the datasets to BIDS, but to direct potential subscribers to its own access platform at a price beyond the capacity of the library to pay. In these instances, the library would have nothing to show for its ten years subscription to the datasets and it will need to address such issues in its collections policy. It might not be necessary to have perpetual real-time access to the dataset, but the library should have the confidence that by paying a subscription over ten years, it has *acquired*, rather than *borrowed*, the dataset for its users.

As libraries build up local collections of digital resources, they will have to address locally the issues of archiving and preservation of the data. Research libraries and archives have taken on the responsibility for archiving and preserving selected printed material as part of their collections policy, and scholars can be reasonably expect to access preserved scholarly material that was published in printed texts over the past four of five centuries. Scholars also need to be confident that digital material produced today will be accessible for future generations and the academic library community has now begun to address this responsibility. However, it needs to be remembered that digital data is simply a sequence of bits, and retrieving a bit stream requires a hardware device, such as a disk drive, and technology for reading the physical representation of the bits from the medium. It also needs a software program and operating system software to interpret the bit stream, as most files contain information that is meaningful solely to the software to run these programs. There will therefore be a need to save the programs that generated the digital documents, as well as the system software to run those programs [35]. The speed of technological change is so fast that the past few years are littered with obsolete technology and with information resources that are unreadable - most libraries can remember the Microcard collections of Parliamentary Papers or the BBC Doomsday Project.

Digital preservation is beyond the ability of most libraries or publishers acting individually, though libraries need to move 'higher up the food chain' to ensure that they have an input at the data creation stage into the implications for long-term preservation. One of the eLib Phase 3 projects, CEDARS, aims to address the strategic, methodological and practical issues involved in the long-term preservation of digital information resources and to provide guidance for libraries in best practice for digital preservation. The project deliverables include:

- guidelines for developing digital collection management policies which may ensure the long-term viability of any digital resources included in a collection;
- demonstrator projects to test and promote the technical and organisational feasibility of the chosen strategy for digital preservation;
- methodological guidelines developed by the demonstrator projects providing guidance about how to preserve different classes of digital resources including detailed advice about appropriate storage media and back-up strategies and data formats;
- analysis of the cost implications of digital preservation.

The results of this and similar projects will provide a framework for a library's digital preservation and archiving collection policy, and help academic libraries decide where they wish to place themselves on this access to holdings continuum.

Finance

Budgeting

Electronic information resources raise a new set of financial issues for the library's collections policy. The first requirement for the library is to find the money to pay for new electronic resources, (including VAT), often in a context of a stable or shrinking budget. In this situation, money for new services can only be found by reallocating or redirecting existing funds, when the demand for traditional services is continuing to grow. As a budgeting principle, it is as well to remember that electronic information resources are more rather than less expensive than print resources, and networked resources are more expensive than stand-alone ones. Unfortunately, this is often not recognised by university management, as the over-vigorous promotion of the concept of the 'virtual library' has led them to assume that it is already here, and that 'common sense' dictates that it must cost less than a print library. A library's existing budgeting traditions will, of course, have a significant effect on the extent of the provision of new electronic information resources. If the bulk of the budget is 'devolved' to departments or faculties, with little 'top slicing', and most of the decisions on purchasing are made by academic staff, then it is likely that there will be few electronic resources available through the library. If such a library is keen to provide leadership in electronic library developments it may need to employ subtle, or even slight-of-hand, budgetary strategies to increase the range of electronic resources. This would contrast with a library where control of the spend rests with the library and where the library staff will be able to meet users' needs (rather than wants), even before they know they have them.

> "Our studies indicate that those libraries which have developed a policy dynamic relating to the provision of information services as a whole, are generally higher than average providers of electronic services...a feature of the management of such libraries is the degree of autonomy awarded to them by their parent bodies." [36]

Consortia Purchasing

One of the recommendations of the Follett Report [37] was that national and regional strategies governing library provision for researchers across all subjects should be developed by the funding councils and other bodies. In 1994, the Anderson Committee was established to follow up this recommendation. Although much of the subsequent report is concerned with the provision of printed resources, there is an acknowledgement that electronic resources should form part of any national strategy. However, the report acknowledges that 'it is unlikely that an electronic approach to comprehensive research provision, despite its undoubted attractions, will offer a feasible base for a research strategy at least in the shorter term, even for journals' [38]. The approach may therefore be through local or regional consortia. Most higher education libraries now belong to a consortium, e.g. CALIM in Manchester, the M25 Group in London [39], and

SCURL in Scotland, and some of these groups are investigating the consortium purchasing of library materials. The usual starting point is to jointly tender for the supply of printed journals, with some consortia now beginning the process of tendering for book supply. When it comes to the joint purchase or licensing of electronic resources, most of the negotiations are undertaken on a UK-wide basis, but some consortia have been in discussions with publishers of electronic sources to explore the possibility for sharing access to resources among members of the consortia. For example, one of the major journal publishers has approached consortia to discuss a framework for providing access to all the electronic versions of their titles to all members of the particular consortia, whether they subscribe to the print version or not. The terms presently attached to the deal, particularly the non-cancellation stipulations, have been unacceptable to most consortia, but it is an indication of how libraries can begin to hunt in packs and obtain financial advantage [40]. However, the significant issues of authentication and access management, that will make this vision of cross-organisational access to networked information resources a reality, have yet to be fully addressed.

Pricing

The financial model that has been used for access to JISC datasets has been based on a flat-rate subscription to each dataset for each institution, regardless of size of institution. This flat rate model could be equated with the model of subscriptions to the printed versions of the dataset, which has a fixed price regardless of the amount of usage. The charging model also included a reduced fee for early sign-up and required a commitment for a period of five years. An alternative model would have been to use a tiered subscription rate or a pay-as-you-use model of access, and the latter could be equated with the model of access to online databases. Although the flat-rate model could be described as a crude mechanism, any variation based on size of institution or usage would have led to endless discussions on the accuracy of the data, and the flat-rate system at least had the advantage of simplicity. Library managers like to operate in an environment of predictable costs, and this is why the subscription model of dataset charging adopted from the beginning for JISC-funded datasets has been favoured by almost all libraries. This model worked reasonably well when there were only 70/80 reasonably homogenous higher education institutions. The removal of the binary line, which had divided universities and polytechnics, increased significantly the size, diversity and missions of higher education institutions, and this has led to pressures for changes to the charging model. The flat rate pricing model was perceived to disadvantage small institutions, who might wish to access the dataset on a pay-as-you-use basis, and the five year subscription period also created difficulties for libraries who are unable to make such long term commitments. After a review of the options, the funding model adopted from 1998 [41] will be one of differential charging for each dataset. There will be between three and five tiers of subscription, and institutions will be placed within tiers by a set of criteria reflecting institutional size, the nature of the institutions relative to the nature of the dataset and specialist factors, such as the presence or otherwise of relevant academic departments. This should now make it easier for smaller libraries to develop collections of electronic resources, but will now involve all libraries in developing strategies to optimise their placing in the subscription tiers for each new JISC dataset.

There are still a wide variety of pricing models used by commercial information providers and it is likely that most of the present models will be unsustainable in the long term. In general, access to the electronic version of a journal is only permitted by a publisher as long as the print version is subscribed to by the library, either for the same price or plus a supplement. Many journal publishers are therefore charging current print price *plus* electronic surcharge *plus* significant projected inflation surcharges, for simultaneous access to the electronic versions of their publications. Libraries are also being asked to support the cost of a publisher's research and development programme. These pricing models are preventing most libraries from establishing strong collections of commercial electronic journals, beyond those provided through the PSLI. Before such pricing practices (which can be print *plus* up to 90%) become the norm, there is a need to develop, preferably in partnership with publishers, new economic models for the pricing of electronic information products. Libraries acting alone cannot influence

publishers and therefore these pricing issues need to be tackled internationally through such initiatives as the International Coalition of Library Consortia (ICOLC) 'Statement of Current Perspective and Preferred Practices for the Selection and Purchase of Electronic Information' [42]. The Statement, which has already been endorsed by consortial representatives from a number of other countries, addresses wider issues than just pricing and includes contract negotiation, data access and archiving, system platforms, licencing terms, information content and its management, and user authentication. The Consortia argue that as 'publishers today increasingly act globally to provide electronic information, it is incumbent upon libraries to act globally to express their market positions on the pricing and other terms and conditions related to the purchase of that information'.

The future

It is already clear that the provision of electronic information resources does not necessarily lead to a reduction in the use of printed resources and there is unlikely therefore to be a withering away of the physical library, at least in the foreseeable future. On the contrary, electronic information has contributed to a significant growth in the use of existing printed resources, and a rediscovery of the printed journal literature as bibliographic datasets act as indexes to the library's collection of printed journals. It has also led to an increase in the demand for inter-library loans, as users became aware of the range of print literature that exists outside their local library through the use of electronic bibliographic datasets. Most libraries have now introduced rationing of inter-library loans either through charging or by allocation.

Libraries will need to develop mature economic models for the provision of electronic information, so that they can make meaningful comparisons between the costs of print and electronic. It is too simplistic just to compare only subscription costs, without looking at the life-time costs of the different delivery options. While a library will need to provide the necessary shelf-space for print resources for which it will not have to fund, the electronic version will require an investment in an appropriate IT infrastructure, which the library may have to fund. Ideally a library manager should be able to have a set of the management tools to compare all the costs of electronic versus print, or access versus holdings. With the move towards desk-top access to information, it is becoming irrelevant to the user where the information is located, either within the library or across the world. The trick for libraries will be to provide, through access, the same reliability of service as they have traditionally provided through holdings, and this requires the development of new economic models. MA/HEM [43] is an example of a software product which is intended to allow libraries to make such comparisons and to help them in evaluating alternative strategies for the provision of information.

Libraries are still in their infancy when it comes to providing access to electronic information resources, but as the majority of the information resources that libraries manage become electronic, they will need to re-engineer themselves and redefine their roles [44]. One of the major changes in higher education which will affect libraries will be an increased role in supporting student learning [45], and in providing managed access to electronic courseware and electronic learning resources, including both 'electronic course readers' [46] and locally on-demand scanned material. Many institutions are therefore re-badging their libraries or investing in new 'Learning Resource Centres', where the management and provision of electronic information and learning resources will be a major activity. At the same time as the library provides increased support for student learning, there could be a decreasing role for the library in support of researchers, as information providers direct their services at the end-user over the network. Publishers will soon be able to provide sophisticated metadata searching facilities to ensure that users find the information that they want and this will be supported by secure online payment facilities to manage the delivery of the information. If the trend of devolved institutional budgeting continues, then researchers are increasingly likely to have control of their own information budgets, with a consequent weakening of the central role of the library in this new electronic environment. On the other hand, it is likely that libraries will have a role in managing and preserving locally and nationally produced digital resources, such as electronic theses and

other 'raw' research material. However, all these developments are still at an early stage, but they do raise a whole new set of issues about the nature of 'collections' and their management, which are outside the scope of this chapter. There is no doubt that librarians with skills in collection management will need to be involved in defining this future if they are to provide the seamless access that our users need. To achieve this effectively librarians will need to expand their roles and become 'knowledge managers', rather than simply 'collection managers' [47].

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